



## FOOD SYSTEM ANALYSIS: AN ASSESSMENT OF FOOD AVAILABILITY AND ACCESSIBILITY

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### ABSTRACT

The food system refers to the chain of activities connecting food production to consumption. Studies on the impact of the globalization of the food system have become increasingly important in the context of food security and highlights that food availability and access are not only a matter of agricultural production, but requires attention to the entire food value chain.

This research initiative will investigate the food system and determine its contribution to the food security status of the community of Avian Park, situated in the Breede Valley in the Western Cape Province of South Africa.

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## 1. INTRODUCTION

Avian Park is a lower socio-economic community situated in the Breede Valley in the Western Cape province of South Africa. It was found that 24% of the residents survived on less than R522 per month in 2010, which is considered to be below the poverty line. These residents often experienced food insecurity in the last year and it appeared that there was a limited access to feeding schemes [11].

This research initiative forms part of a multi disciplinary research project conducted by the Division of Human Nutrition, Stellenbosch University. It is a baseline study that falls under the Stellenbosch University Food Security Initiative of which the Department of Industrial Engineering is a participant. These investigations will form the basis for further in-depth studies and a long term commitment for the design and implementation of community food security strategies that would contribute to the resilience of the local food system [19].

The focus of this paper is to give an outline of how food security can be approached from an engineering perspective. A methodology was developed on how to measure food security by means of investigating the food system. This methodology will be presented in the paper and applied to the food system of Avian Park in the future to determine its contribution to the food security status of the community.

As far as the structure of the paper is concerned, the forthcoming section will provide a background by explaining the concept of food security and the current condition in South Africa. Thereafter, the paper will investigate literature on the food system with a special emphasis on the retail sector. Then community food security and how this is dependent on the food system will be discussed. This creates a framework from which the methodology was developed and it will be presented in the final section of the paper.

## 2. BACKGROUND

### 2.1 Defining and measuring Food Security

The currently accepted definition for food security states that

*“Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life”* [8].

This definition emphasises that there is not only a need to have adequate supplies of food available, but sustainable access to this food is needed to ensure food security.

Food security is a broad and multidimensional phenomenon and it consists of three dimensions; food availability, accessibility and utilization [15][8]. Food availability usually refers to adequate quantities of food available for consumption. Food access depends on the physical access to market outlets and on the purchasing power of a household and food utilization is concerned with the proper biological use of food [21].

The conceptual framework of food security illustrated in fig. 1 provides a graphical example of food security with all its dimensions. This framework also shows the broad amount of factors that need to be taken into account when measuring or monitoring food security. Currently in South Africa there is no nationally accepted or specific measure for food security, this makes the monitoring and managing of food security extremely difficult or even impossible. There are several different measurement methods of food security and each one will generate various types of information [1].

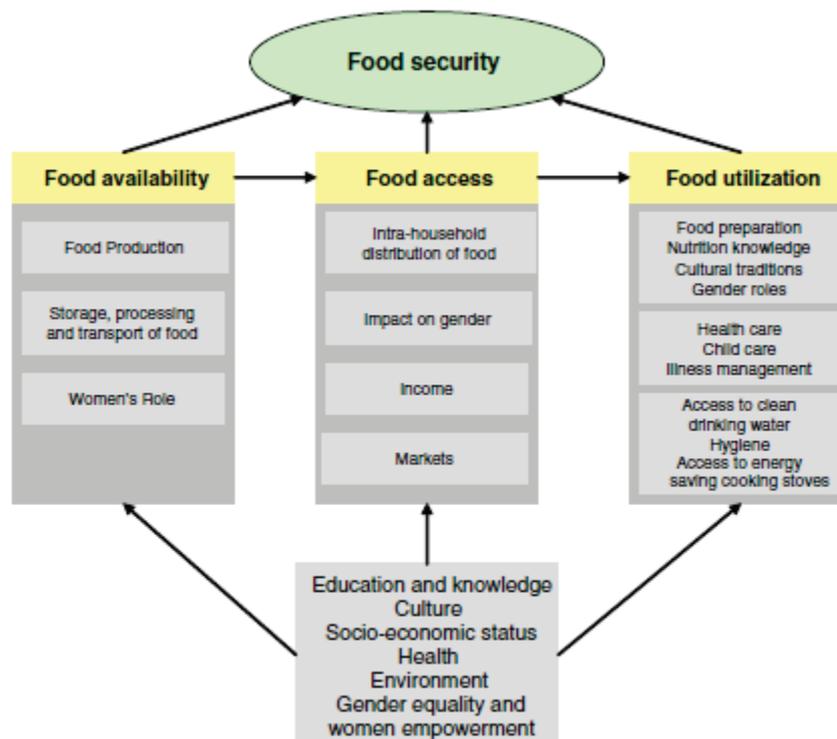


Figure 1: Conceptual framework for food insecurity [21]

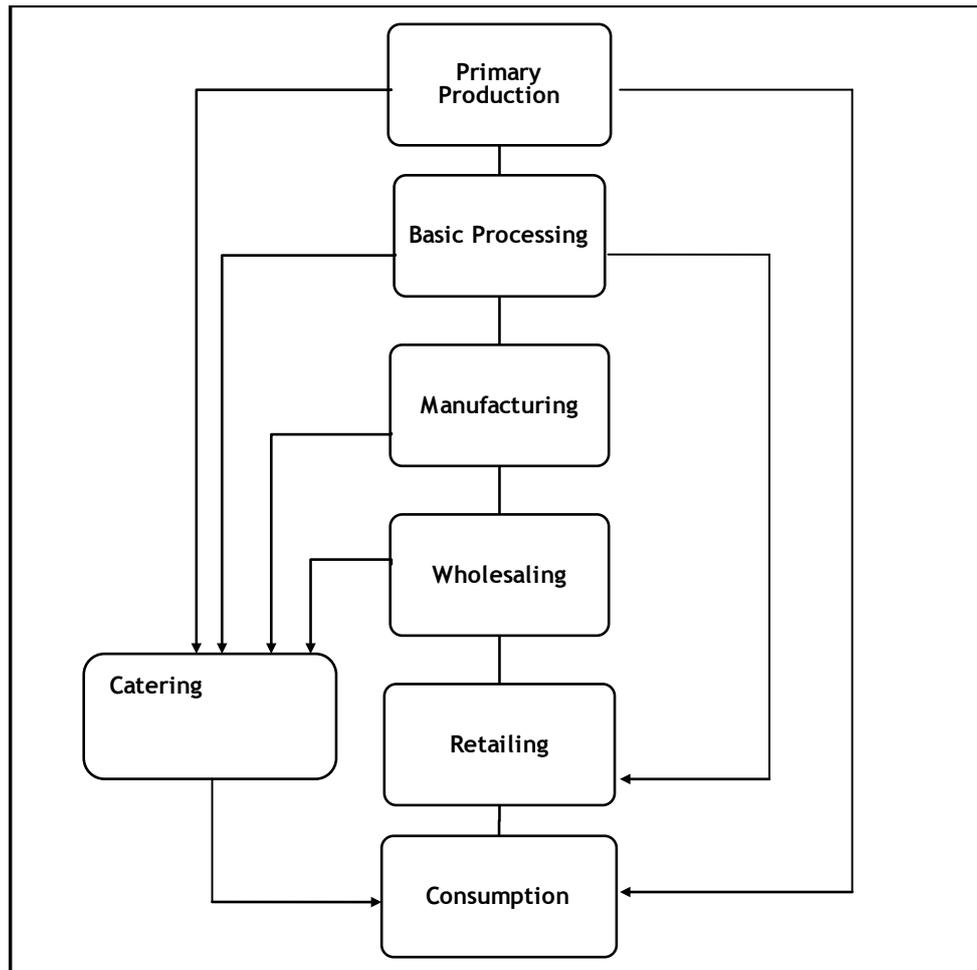
## 2.2 Food Security in South Africa

South Africa's food security status may be misleading; although the country is food secure as a whole, a large proportion of households are still considered to be food insecure. The National Food Consumption Survey (NFCS) of 2005 recorded that 52% of South African households experienced hunger and in 2010, 60% of all deaths of children below five years of age were associated with malnutrition [26][15].

Food insecurity in South Africa is not due to a shortage of food in the country, but rather caused by inadequate access to food [28]. To better understand and improve the household food insecurity status in this country, it is necessary to investigate how the dynamics of the food system function and a clearer understanding of food value chains and other structural constraints are required [1].

## 3. THE FOOD SYSTEM

The food system refers to the chain of activities connecting food production, processing, manufacturing, distribution, retailing and consumption [23]. The term 'food value chain' or 'food supply chain' can also be used to analyze how raw commodities obtain value added to them along the chain [4]. For this research project the food system will be investigated and analyzed as a value chain.



**Figure 2: The Food System [23]**

The ability to access food is strongly influenced by the broader context (local, national and global) and by the systems or networks in which households pursue their livelihoods [10]. This is why it is important to first investigate the global environment in which the local functions. South African consumers will experience the effects of changes in the global food system. Even the most remote rural households feel the impacts of certain global events and the most severely affected will probably be the poor and those currently food-insecure [12][1].

The globalisation of the food system has produced a variety of benefits and can deliver, in theory, enough food to end world hunger [7]. For those who are in the position of access to this food, there are increased varieties of foods available to consumers in and out of season. Studies on the impact of the industrialization and globalisation of the food system have become increasingly important in the context of food security.

Globally there are 25 000 products in the average supermarket and more than 20 000 new packaged foods and beverages were introduced in 2002 alone [16]. Most supermarkets are owned by major international retail corporations and this leads to more concentration in the procurement and distribution of foods [2]. The top 10 food retailers control 24% of the global food market and the top 10 food and beverage processing companies control 24% of the global market of packaged foods [8][4].

With all the success over the past few decades in the globalised food system, there are some factors of concern, especially food security are threatened [4]. Thus, it is important to take a critical look at the modernised food system and to highlight that food availability and accessibility are not only a matter of agricultural production, but requires attention to the entire food value chain [16].

## **4. THE RETAIL SECTOR**

### **4.1 The Global Retail Sector**

The efficacy of the food distribution or retail network is integral to the entire food system. Without sufficient supply, distribution resources cannot function to provide for consumers and without consumer demand, distributors will not be able to sell food. Distributors serve as an interface between customers and food products. It is challenging to develop quantitative measures for distribution, but it is possible to evaluate the degree to which various forms of distribution and retail outlets contribute to food security [18].

There has been a rapid growth of supermarkets globally and this created fundamental changes in the food system [30]. Research has shown that modern retail may threaten the sustainability of agrifood systems, rural or small farmers and the environment [25] [29][30][16]. On the other hand it can be seen as an important contributor to food security as it can ensure a regular supply of food at the best prices and create opportunities for rural farmers [13][17][27].

Access to stores that sell affordable, nutritious food is a prerequisite for adopting a healthy diet [9][5]. In the globalised food system, food retail represents food availability and accessibility.

### **4.2 The South African Retail Sector**

Supermarkets grew from having only 5-10% of the retail sector in the mid- to late 1990s in South Africa to 30-50% by 2004 [30]. The four largest retailers in South Africa are Pick n Pay, Woolworths, Shoprite Checkers and Spar and households purchase 70-90% of their food supplies from these major retailers [1].

Traditional retailers refers to small, local or spaza (Zulu for ``hidden``) shops. They usually make up the retail environment in many low-income or rural communities [6]. Many healthier food choices are not available in these local shops and this inhibits low-income households to consume a healthy diet [14].

These types of retail outlets cannot match the economies of scale of supermarkets. It has been noted that the prices of food tend to be higher in these local shops compared to supermarkets and to the national average prices [25]. The distribution patterns of food will affect the retail price of food [24]. A study conducted in the Transkei, South Africa, determined that the higher prices in local shops are due to the result of transportation and distribution costs. The local shops procured food from the same supermarkets where households, that can access these supermarkets, did their shopping. It was found that the mark-up (defined as the margin between the wholesale price and the retail in the local shops) were as high as 39% [6].

Supermarkets are in the position to manage their supply chains better compared to traditional retailers. Their procurement and distribution systems are more efficient, this usually drives down costs. Rural storeowners sometimes abuse their monopolistic position in rural and poor communities by charging excessive prices [6].

## 5. COMMUNITY FOOD SECURITY

The food security status of a community is intricately dependant on the community's food system. The definition of community food security confirms this by stating that community residents must be able to obtain a nutritionally adequate diet through a sustainable food system that is economically and environmentally sound [9].

Community food security depends on the availability, quality and affordability of a variety of food items sold through retail and any other food sources. More specifically, a community may be considered to be food insecure if there are inadequate resources from which people can purchase foods, if the available food purchasing resources are not accessible to all community members, if the available food is not sufficient in quantity or variety, or if the available food is not affordable to all the households within the community [5].

## 6. FOOD SYSTEM ANALYSIS

The previous sections provided the background and framework from which the following methodology was developed. This methodology describes a systematic approach to measure food security by means of investigating the food system. At each step a set of measuring indicators are supplied that can be used to quantify the data. The necessary data required and research methodology is also given.

### 6.1 Analyzing Food Availability

Indicator	Data Required	Research Methodology	Research Outcome
Number of Retail outlets per capita	Number and type of retail outlets in the community Number of residents	Food Store Survey Census data	Indication of how well the community is served by the retail food sector
Food availability	Variety of food available in different retail outlets	Food Store Survey	

**Table 1: Food Availability Indicators**

Comparisons of the availability and variety of different food categories across different retail outlets must be made to create a clear profile of the food system [5].

## 6.2 Analyzing Food Accessibility

Indicator	Data Required	Research Methodology	Research Outcome
Percentage of population within walking distance of a supermarket	Geographical location of retail outlets Geographical location of households	GIS Database	Physical accessibility to retail outlets
Percentage of population that has personal transportation resources available	Personal transportation resource ownership	Food procurement and household food inventory questionnaire	
Purchasing power of household	Food prices Household Income	Food Store Survey Socio-demographic questionnaire	Economic accessibility to available food

**Table 2: Food Accessibility Indicators**

Physical accessibility to the available food depends on the distances from households in the community to the retail outlets. Walking distance is considered to be 450m. Private or public transportation plays a key role in this assessment [5].

Economical accessibility to the available food depends on the purchasing power of a household. This is dependent on the food prices and the income of households. The percentage of the population that can afford a nutritious food basket compared to their income must be determined.

Price comparisons across different types of retail outlets and across different food categories must also be made to create a clear profile of the food system.

## 6.3 Analyzing Food Distribution

Indicator	Data Required	Research Methodology	Research Outcome
Retailer: source of food	Data from local retailers on where they source their food from	Food store survey	Broad overview of distribution patterns for parts of the food value chain
Consumer: purchase location	Data of where people purchase their food from	Food procurement and household food inventory questionnaire	
Farmer: produce destination	Data of where farmers sell their food to	Food distribution questionnaire	

**Table 3: Food Distribution Indicators**

A broad overview of the distribution patterns of a community's food system will enable a simple value chain analysis that will indicate if there are any structural constraints that contributing to higher food prices [20].

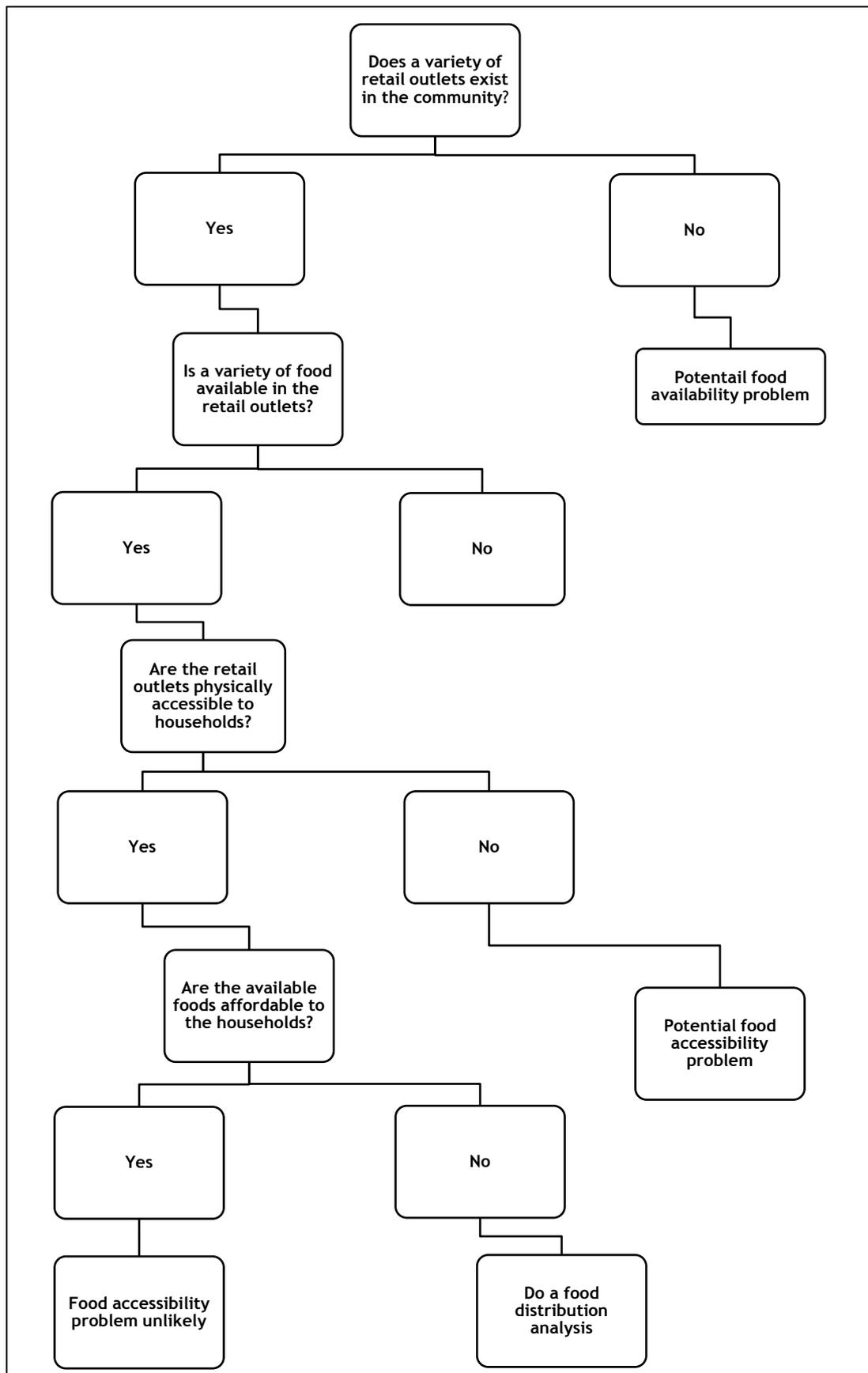


Figure 3: A systematic approach to food system analysis [5]

## 7. CONCLUSION

The availability and access to nutritious food is essential and foundational for the food security status of a community. This can be measured by applying the proposed methodology to analyze the food system in which a community operates.

A survey, based on the United States Department of Agriculture Food Store Survey, will be used to collect data on the availability, prices and source of nutritious food in the retail sector of Avian Park. This data combined with the data supplied by the Division of Human Nutrition, Stellenbosch, will be analyzed to determine how the food system contributes to the food security status of Avian Park. This will create information that can inform decision- and policy making and funding with reference to the food system [29]. It is envisaged that a monitoring system with a clear set of indicators can be established to measure and manage the food security status of the community of Avian Park.

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